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# Performance of Friction Damper for Dynamic Response Reduction of Seismically Excited Knee Braced Steel Frames

**Gholizad.A[1], Kamrani Moghaddam.P[2]**

**1-Assistant Professor, Civil Engineering Department, University of Mohaghegh Ardabili, Ardabil, Iran,**

**2- MSc Student, Civil Engineering Department, University of Mohaghegh Ardabili, Ardabil, Iran**

Gholizad@uma.ac.ir

**Abstract**

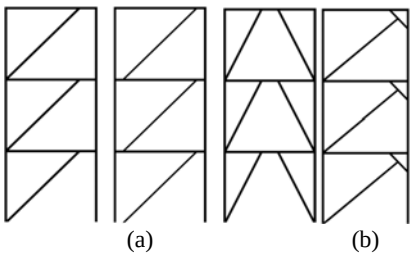
High performance and reliability of refurbish able knee braced steel frames has been confirmed in previous researches trying to get an optimal design for its configuration. Buckling of diagonal member which affects the hysteretic behavior of KBF under cyclic loadings has not been foreseen in previous evaluations of this system. This deficiency can be improved by utilization of adjustable rotary friction damper device (FDD) as knee element. Diagonal element buckling can be prevented considering a suitable value for FDD sliding threshold moment (Mf). Nonlinear time history analyses have been performed to evaluate the response of single story KBF subjected to seismic record. Optimal Mf in FDD has been chosen for these analyses. Roof displacement and acceleration, base shear and diagonal element's buckling status have been compared in KBF and FKBF with different configurations. More than 89% displacement response reduction has been earned for the FKBF without considerable increase in base shear.

**Keywords: Knee Braced Steel Frame, Buckling, Friction Damper,Dynamic Analysis.**

## 1. INTRODUCTION

Science and technology development in recent decades causes the structures' design to move from reliance on the elastic designs to the consideration of inelastic deformation (ductility) of structure to dissipate input seismic energy and the application of structural control devices to improve dynamic responses.

Moment-resisting frame (MRF) and concentrically braced frame (CBF) are ordinary types of earthquake resisting systems for steel structures. Excellent ductility of MRF which provides energy dissipation in a good level and considerable stiffness of CBF which limits the drifts are major advantages of these traditional systems. These advantages have been gathered together in eccentrically braced frame (EBF) proposed by Roeder and Popov [1], see Figure 1(a).



(a) (b)

**Figure 1. (a) Conventional EBF Systems, (b) KBF System General Configuration**

In this system brace elements provide frame's stiffness and ductility is provided by link with flexural or shear hings. These sacrificial components form on the end or mid of gravity loads bearing girders in the mostly known configurations of EBF systems leads to uneconomically large sections for beams. Furthermore, fuse element as a part of a main structure is needed to be changed after plastic formation which is not economically in the most cases. However, recently lots of researchers have been interested in seismic performance of EBF and preformed so many useful studies on this topic [2].